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SELF-POLLINATION AND SELF-FERTILITY IN EIGHT CULTIVARS OF BLACK CURRANT (*RIBES NIGRUM* L.)

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A four-year study examined the degree of self-pollination and self-fertility in the following cultivars of *Ribes nigrum* L.: Ben Alder, Ben Lomond, Ben Nevis, Ben Tirran, Ceres, Ojebyn, Titania and Triton. The percentage of flowers setting fruit largely depended on the cultivar and on the pollination treatment. The most fruits (over 60%) were obtained in free-pollination conditions; 44–64% fruit set occurred when flowers were pollinated with their own pollen, and ~20% after self-pollination. In cultivars Ojebyn, Ben Nevis, Ben Lomond, Ben Alder, Ben Tirran and Triton, which are largely self-fertile, there was no significant difference in fruit set between own pollen and free pollination. Cultivars Ceres and Titania had the lowest degree of self-fertility (~44%). Flowers of Ben Lomond were most capable of self-pollination (~45%). All cultivars examined require pollinating insects during flowering for satisfactory yield.

Key words: Black currant, *Ribes nigrum*, self-pollination, self-fertilization.

INTRODUCTION

Black currant is a very important soft fruit crop in Poland. The quality of bush yield depends on agronomic factors and pollination processes. Pollination and fertilization are quite complex in black currant. The degree of flower pollination crucially depends on the kind of pollen vector, while fertilization depends on the number of pollen grains reaching the stigma (Lech, 1976; Denisow, 2002a,b). In the literature there are different views about self-fertilization and self-sterility and self- and cross-pollination in the same cultivars (Gwozdecki and Smolarz, 1974; Kołtowski et al., 1999). Self-fertility and self-pollination ability are reported to vary greatly between cultivars. The reasons for this include genetic differences between cultivars, a considerably higher position of the stigma versus the anthers (mainly in the top flowers of the raceme), differences in pollen viability, and different temperature conditions throughout flowering, which can frequently stop the development of pollen tubes (Lech, 1976; Nyéki and Soltész, 1996; Kołtowski et al., 1997).

This study analyzed the pollination requirements of some commonly cultivated black currant cultivars in an investigation of their degree of self-pollination and self-fertility.

MATERIALS AND METHODS

The experiment was conducted in Pulawy (51°24"N 22°00"E), Poland in 1994–1997, using the commonly cultivated black currant cultivars Ben Alder, Ben Lomond, Ben Nevis, Ben Tirran, Ceres, Ojebyn, Titania and Triton. The randomized block method entailed four replications with five plants per plot. The bushes were grown on pseudopodsolic soil rated as class IV. Three basic pollination treatments were applied. Treatment A was free pollination with unlimited access to bushes of different pollinators. Treatment B was pollination with own pollen by one bumblebee queen under a net isolator, for estimation of self-fertility. Treatment C was self-pollination without insects under an isolator, for estimation of self-pollination ability. The degree of self-fertility

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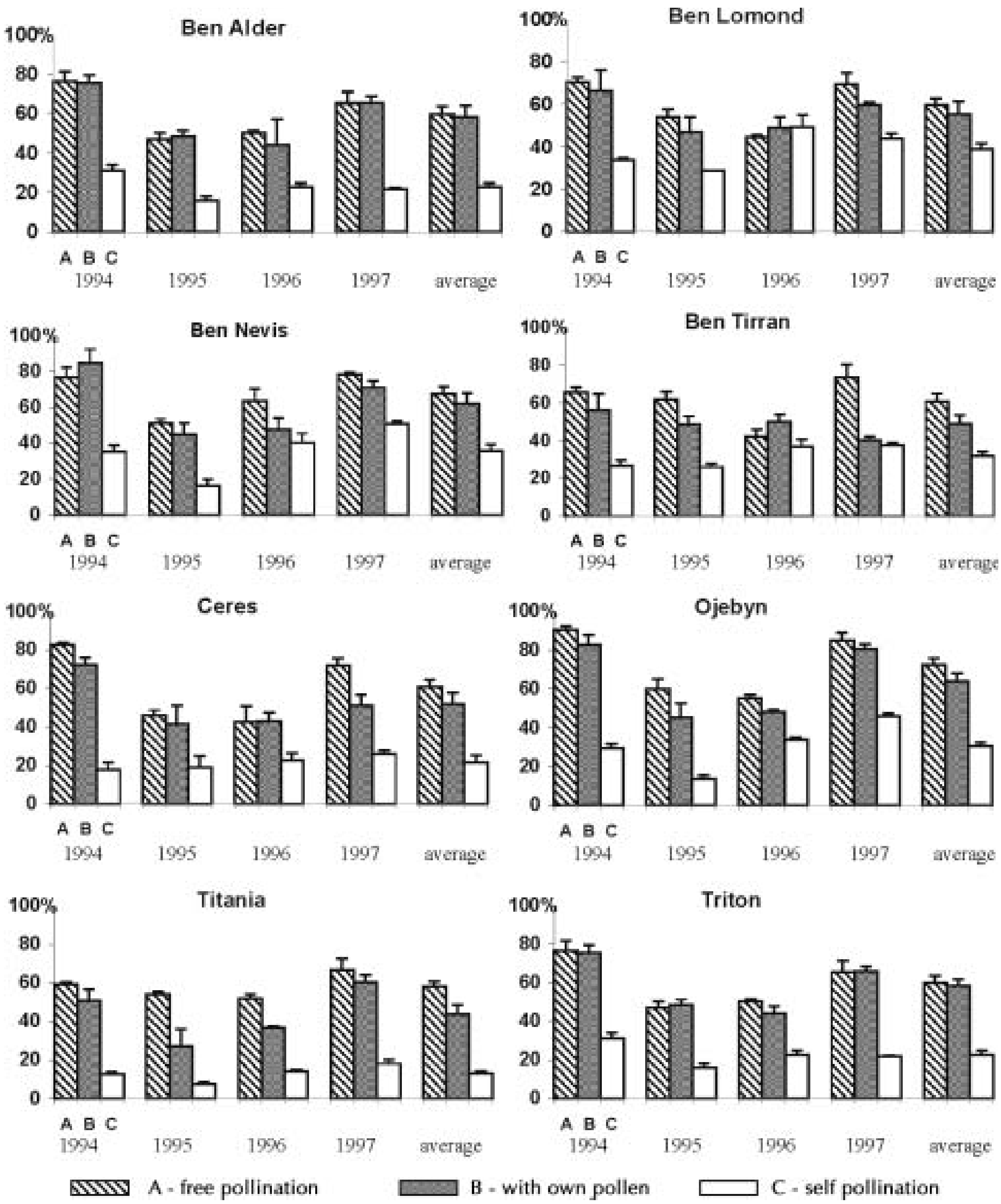

Fig. 1. Percentage of flowers setting fruit in eight cultivars of black currant, versus manner of pollination, in 1994–1997.

and self-pollination was estimated by the percentage of flowers setting fruit. In every year of the study, 8 bushes of each cultivar in the A pollination treatment were examined, and 4 plants of each cultivar in B and C. In 1994 the number of flowers and fruits per bush were counted; in 1995–1997 the number of flowers and fruits from 3–4 randomly chosen branches per plant were analyzed.

During the years of the study in the flowering period the minimum day temperature was 3.2˚C and the maximum 12.0˚C, except in 1996 when they were 9.1˚C and 21.0˚C, respectively.

Data are shown as means and standard deviations. The significance of differences between treatments and cultivars was tested by double-factor ANOVA with Duncan's test. The level of significance was taken as $p = 0.05$.

RESULTS

The percentage of flowers setting fruit depended most on the kind of pollination method used, other significant factors being the year of the experiment and the type of cultivar. The largest number of fruits was reported on bushes of all cultivars with free access of pollinating insects. In such conditions ~60% of flowers set fruit, up to 70% for Ojebyn (Fig. 1). Pollination with own pollen by one bumblebee under a net isolator was equally productive for six cultivars (Ojebyn, Ben Nevis, Ben Lomond, Ben Alder, Triton, Ben Tirran). Titania and Ceres had the lowest degree of self-fertilization, producing with a ~25% lower fruit-to-flower ratio than in free pollination. Self-pollination produced the lowest percentage of fruit, with Ben Lomond cultivar producing the highest fruit set (45%) in these conditions, and Titania and Ceres the lowest (less than 20%). The remaining cultivars produced ~30%. There were significant between-year differences in the number of fruits under free pollination as well as pollination with own pollen. That difference was small in self-pollinated flowers. In 1994 and 1997, ~70% of free-pollinated flowers set fruit. In 1996, after a severe winter, the bee colonies were weak, bees did not visit plantations frequently, and the free-pollinated flowers gave only 45% fruit. In the same year the differences in fruit set between treatments A (48%) and B (45%) were not significant. This result shows the importance of anticipating the density of available pollinators when planning a black currant plantation.

DISCUSSION

In this experiment the highest percentage of flowers producing berries was achieved through free pollination. This result supports the suggestions of many authors (e.g., Kołtowski et al., 1997, 1999; Denisow, 2002a,b) regarding the importance of insects in pollination and their positive influence on black currant fruit set. Pluta and Żurawicz (1992) did not report a significant difference in the number of berries between pollination with free access for insects and self-pollination, but their results were based on a one-year experiment. In the present study the degree of self-fertilization in the cultivars was evaluated from the treatment in which one bumblebee queen under an isolator pollinated flowers with own pollen. The lowest degree of self-fertilization was shown by Titania (~40% set fruits) and Ceres (45%). Kołtowski et al. (1997) reported a similar degree of self-fertility, or even lower for Titania (~34%). Ceres and Titania also can be regarded as the least capable of self-pollination, again in accord with Kołtowski et al. (1997). Gwozdecki and Smolarz (1974) described a similar correlation between self-fertility and self-pollination in black current cultivars. Note that Titania, which gives a weak crop under self-pollination, set fruits satisfactorily under free-pollination. This must be related to the benefit of having more pollen on the stigmas of free-pollinated flowers (Lech, 1976; Denisow, 2002a).

The highest self-fertility was in Ben Nevis and Ojebyn, which produced more than 60% berries from flowers pollinated with own pollen by one bumblebee queen, while in complete isolation only 30% of the flowers set fruit. Thus, self-pollination does not guarantee good fructification of even cultivars having the highest degree of self-fertility. This underlines the importance of the honeybee in black currant pollination, as Kołtowski et al. (1997, 1999) have suggested.

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